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Original Article

An iterative approach to enhance the clinical learning experience in Macao nursing education

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ABSTRACT

Objective: The aim of this study was to reduce or eliminate the stressors to enhance nursing students' clinical learning experience through implementation of an iterative approach that developed a personalised response to student stress.

Methods: A prospective cohort research design was applied to collect data from a sample of undergraduate nursing students across the four study years. An iterative approach was employed to improve students' learning experience and the Stressors in Nursing Students Scale-Chinese Version (SINS-CN) was used to measure student stress. Key problems encountered by students were identified, refined and the responding solutions were worked out and implemented among this group of students through their first year to fourth year.

Results: The overall SINS-CN mean score (2.17–2.82) of students was declined to a moderate level.

Conclusions: Having implemented iterative approach to address factors that led to stressful environments encountered by the nursing students, the overall stress score and each sub-dimension score decreased significantly. Therefore, it is recommended that this approach could be adopted by other colleagues in the nursing arena around the world.

1. Introduction

Clinical placements for nursing students are essential and perceived as an irreplaceable component of nursing education [1]. Usually, it accounts for at least one third to one half of the total learning hours of an undergraduate program, although this can vary significantly from one country to another. Clinical placement is also perceived as the primary mechanism for translating theoretical knowledge into practice and is the cornerstone of nursing as a health profession [2]. However, existing evidence indicates that nursing students experience higher levels of stress than those students in other disciplines [3,4], particularly when in the clinical learning environment [5]. In fact Martose and colleagues suggests that clinical practice produces the highest level of stress for nursing students, compared to other aspects of the programme [6]. Similarly, Parveen and Inayat found that the clinical environment, alongside the academic workload, are for many students the causes of high levels of distress which impact on both their physical and mental health [7,8]. This in turn may negatively impact on achievement, inhibiting their progress towards successful accreditation and employment as a nurse [9]. This has consequences, for the nursing workforce as it negatively impacts on the reputation of the profession causing attrition and increasing the shortage of nurses in practice.

Like many other countries and regions, the Macao special administrative region (Macao SAR) has been suffering nursing workforce shortages. To solve the problem, the government has, since 2008, invested significantly in nursing education agencies in order to train more nurses [10]. However, the attrition rate from nursing programs in Macao is worryingly high. An internal report from the Student Affairs Office of a public school indicates that the attrition rate for nursing students is between 8% and 10%. This represents significant wastage and cost [11]. Although the reasons for leaving a nursing program are many and varied, inability to cope with the stress of the program, including the clinical learning environments and academic workload are commonly cited [5,12,13].

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Macao SAR hosts two nurse education providers which receive funding either through charitable status or public funding from government sources. There have been significant developments in education structure and status, since 1999, with a move from diploma (3-year) to Baccalaureate Degree (4-year) programmes [10]. About 60–70 nursing freshmen are annually enrolled in each of the schools. The curriculum designs in both schools are quite similar and also more or less the same as in other vicinity regions such as Hong Kong and China mainland, although the clinical placement hours are much higher than others [5]. According to the Macao SAR government authority's requirement, the clinical placement hours for baccalaureate degree program must be 1500 hours or above. In this context, nursing students spend almost half of their total learning hours in the clinical practice (1656 clinical hours/3396 total learning hours) [14].

In order to identify whether nursing students in Macao SAR experience stressful learning circumstances and the common sources of stress, a research team from the public school conducted a preliminary study in 2013. It was a cross-sectional study with a sample of 203 first-year to fourth-year nursing students, which was published in 2015 by Liu and colleagues. Stress was revealed as common experience amongst the students, with 'clinical' and 'education' factors being cited as within the top ten origins of stress for the students [5].

To address this problem and develop this work further, in 2014, the Macao team began to continuously collect the information from each semester's School-Student Dialogue event to further identify the key problems faced by students in clinical placement. Based on all collected information, we employed an iterative method to refine understanding of the problem and to target improvements to the clinical learning environment for the students. The term 'iteration', originally used in computer engineering, is "the process of doing something again and again, usually to improve it" defined in Cambridge Online Dictionary [15]. "An iterative approach" in this paper is defined as a cyclic process of collecting information, analyzing, refining students' problems and implementing measures till improving the situations. The purpose of the study was to reduce or eliminate the identified stressors and to enhance nursing students' clinical experience through implementation of iterative problem-solving approach. This study is a follow on from a previous study, but is completely separated in all other ways.

2. Methods

2.1. Study design

This is a prospective cohort research design to collect data from a sample of undergraduate nursing students across the four study years. An iterative approach was employed to improve students' learning experience.

2.2. Setting and sample

The study took place in a public higher education institution in Macao SAR. The participants included all full-time teaching staff in a nursing program and one cohort of nursing students who enrolled in the nursing program in 2014, which was a different group of students from the 2013 study. A prospective cohort research design was used to follow this group of students across different years of study. Attrition caused the sample to decrease across each study year (the first year, $n = 62$; the second year, $n = 54$; the third year, $n = 50$; the fourth year $n = 48$). The detained students were excluded from the study.

2.3. Ethical consideration

Prior to implementing this study, ethical approval was achieved through the Research Ethics Committee of the Institute. The key ethical issues addressed included achieving signed consent from all participants, prior to data collection, and assuring them of confidentiality through anonymisation of all data. The principal investigator for the study also sought and achieved permission to use the Stressors in Nursing Students Scale-Chinese Version (SINS-CN).

2.4. Iterative methods

An iterative design is a design methodology that is based on a cyclic process of analyzing and refining an activity or process. The results of the analysis following each iteration allows for changes and refinements to be made. Rigor is achieved through the systematic, repetitive, and recursive nature of the qualitative data analysis.

All nursing faculty ($n = 17$) were invited to participate in the study and several clinical preceptors were consulted. Both nursing faculty and clinical preceptors were provided with a briefing based on the information obtained from year 2013's study, and the School-Student dialog events. Each problem relating to the nursing student clinical placement was fully discussed and the refined solutions for each problem were listed, implemented, refined and re-implemented. Key problems and responding solutions are listed in Table 1.

2.5. Measurements/instruments

Anonymized demographic data relating to students was obtained along with data from the Stressors in Nursing Students Scale-Chinese Version (SINS-CN). The SINS-CN, is a validated tool (Internal consistency using Cronbach's α is >0.7 [16]. Test-retest reliability with 2-week interval for the overall instrument 0.82, for sub-dimensions 0.70–0.88), that explores student stress through a 43-item questionnaire. It is self-administered and examines the whole student journey through their academic and clinical practice experience. It focuses on a wide range of pertinent issues such as wellbeing, economic status and time, asking students to rate their responses on a five-point Likert scale, with 1 'being not stressful' to 5 'being extremely stressful'.

2.6. Data collection/procedure

The researchers delivered the questionnaire to all enrolled nursing students (different group of 2013's study) in the year 2014 at the end of first year, at the point in time when they finished their clinical placement. Follow-up data collection was also conducted at a similar time in the second, third and fourth year. To encourage questionnaire completion, containers were conveniently placed in which participants could submit their completed questionnaires.

Following data analysis, the main findings were highlighted and submitted to a dedicated teaching staff event to commence the iterative process and discuss and work out corresponding solutions.

2.7. Data analysis

To support data handling and analysis, the Statistical Package for the Social Sciences (v20) was used. The socio-demographic data and SINS-CN data was analyzed and presented in the form of simple descriptive statistics. Post hoc analysis was employed to compare the mean scores of the four factors between different cohort students.

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Table 1
Key problems and responding solutions.

Problems	Initial solution(s)	2nd Refined solution(s)	3rd Refined solution(s)
Students stressed because of lacking of confidence in clinic	Increasing compulsory practice hours in school laboratory	Inviting teaching staff or senior student helpers to supervise students' practice in the laboratory	Setting up a "Rainbow family" that is each freshman is paired with one or two senior nursing students as his/her mentor(s)
Students stressed because of fearing mistake in clinical placement	Increasing compulsory practice hours in school laboratory	Limiting the number of students under each preceptor. Organizing sharing meeting with outstanding senior students	Conducting special workshop for students at the beginning of each academic year. The topics include stress management, patient safety, infectious disease protection and prevention, etc.
Students stressed because of workload and overwhelmed responsibility	Simply reducing students' assignments	Integrating the assignments from both clinic preceptor's and school faculty's	Employing team-based learning (TBL) strategy for students to identify caring issues or cases in the ward and to finish report and evaluation as a team Briefing and negotiating with clinical preceptors or head nurses that students cannot be used as 'extra staff' and cannot be given a level of responsibility beyond their experience level
Students stressed because of the differences between what learned and clinical real practice	Briefing all preceptors before and after students' clinical placement in each semester	Briefing and debriefing all preceptors before and after students' clinical placement in each semester. Updating the clinical placement handbook in each academic year	Conducting clinical preceptor training program, which makes the preceptors exactly know what students learned in the school and improve their precepting skills

3. Results

3.1. Demographic characteristics of participants

Demographic characteristics of each cohort of students are presented in Table 2.

Attrition of students across each year caused the number of participants to decrease across each year.

3.2. Level of stress and factors associated with stress

The overall SINS-CN scores were 2.17 ± 0.52, 2.25 ± 0.37, 2.82 ± 0.68, and 2.76 ± 0.47 in the first year, second year, third year, and fourth year, respectively. The different dimensions' scores and the comparisons among scores of students in each year are presented in Table 3. The researchers further explored the demographic variables which might be related to the students' stress. However, no statistical significance was found in any variables except year of study. Differences with statistic significance were found among overall SINS-CN scores and the education dimension scores of students in each year. Further analysis of multi-group comparison found that students' overall score and the education dimension score in the third year were higher than those in other years, but still remained at a moderate level.

3.3. Common stressors

The five most highly scoring common stressors perceived by students in each year are presented in Table 4. Most of them belonged to the clinical and education dimensions.

4. Discussion

Whilst iterative approach is most typically applied in computer engineering to identify the optimum programming solution [17], this study reveals it is a useful approach to identify, analyze and understand the nature and causes of students' stress. It then facilitates the generation and reframing of as many ideas as possible, to make them more relevant or feasible. The resulting solutions are implemented for each problem encountered by students in the clinical environment.

An example of this process for one of the top stressors for these students was '*fearing making a mistake in clinical placement*'. The initial solution was to increase compulsory practice hours in a school laboratory to allow greater rehearsal and gain confidence, however, this solution was found not to be effective. After further reflection and discussion with all teaching staff and clinical preceptors, this single solution was refined several times, and the final implemented solution included a) limiting the number of students under each preceptor, b) organizing sharing meetings with high

Table 2
Demographic Characteristics of participants [*n* (%)].

Characteristics	1st year ($n = 62$)	2nd year ($n = 54$)	3rd year ($n = 50$)	4th year ($n = 48$)
Gender				
Male	11 (17.7)	10 (18.5)	7 (14.0)	6 (12.5)
Female	51 (82.3)	44 (81.5)	43 (86.0)	42 (87.5)
Age, *Mean* ± *SD*	19.3 ± 1.2	20.4 ± 1.3	21.4 ± 1.3	22.4 ± 1.3
Marriage status				
Single	62 (100)	54 (100)	49 (98.0)	47 (97.9)
Married	0	0	1 (2.0)	1 (2.1)
Parents' marriage status				
Married	48 (77.6)	42 (78.2)	37 (74.0)	34 (70.8)
Divorced	6 (8.6)	5 (9.3)	5 (10.0)	6 (12.5)
Separated	4 (6.9)	5 (9.3)	5 (10.0)	6 (12.5
Others	4 (6.9)	2 (3.2)	3 (6.0)	2 (4.2)

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Table 3
Comparison between each cohort students with overall SINS-CN and sub-dimensions (*Mean* ± *SD*).

Scale and sub-dimensions	1st year ($n = 62$)	2nd year ($n = 54$)	3rd year ($n = 50$)	4th year ($n = 48$)	*F*	*P*
Overall scale	2.17 ± 0.52	2.25 ± 0.37	2.82 ± 0.68 *	2.76 ± 0.47	3.429	**0.018**
Clinical	2.29 ± 0.54	2.63 ± 0.48	2.53 ± 0.56	2.55 ± 0.51	0.639	0.591
Confidence	2.41 ± 0.68	2.35 ± 0.61	2.52 ± 0.67	2.52 ± 0.60	0.773	0.510
Finance & time	1.99 ± 0.70	2.60 ± 0.72	2.84 ± 0.63	2.56 ± 0.57	1.441	0.232
Education	2.53 ± 0.66	2.01 ± 0.53	3.07 ± 0.52 *	2.39 ± 0.55	5.098	**0.002**

Note: * The score is higher than scores in other three cohorts.

performing senior students, and c) conducting a special workshop for students at the beginning of each academic year to reduce anxiety. Another example was '*heavy workload and overwhelmed with responsibility*'. The initial solution was simply "reducing assignments"; the second-refined solution added "integrating the assignments set by both the clinical preceptor and the school faculty" while the final solutions included a) employing a team-based learning (TBL) strategy for students to identify cases in the ward and to prepare and evaluate a report as a team, and b) briefing and negotiating with the clinical preceptors and head nurses that students cannot be used as 'extra staff', and cannot give a level of responsibility beyond their experience level. This idea was also supported by other scholars [4].

In terms of the most common stressors ranked by the different year students (Table 4), there were differences between the most common stressors encountered by students in first year to those in their second, third, and fourth year. The "*amount of classwork materials to be learned*" and "*the difficulty of the classwork material to be learned*" were significant stressors for those in first year. This may be because they had only 4 weeks clinical placement in which most of their time was spent observing, where there was little risk of making a mistake in practice. The first year students concern mainly focused on managing their workload and the immediate difficulty of the classwork material or examinations, such as the bilingual (Chinese and English) teaching and learning. The "*Fear of making a mistake in clinical placements*" and "*having too much clinical responsibility*" were ranked most highly by students in second, third, and fourth year. This is because they spend much more time and formally do more work in the clinical areas than they do in first year. The high scores in these two stressors could be the result of a lack of confidence and their 'fears' could also have been exaggerated by the preceptors' high expectations of the students' performance [18]. Due to staffing shortage, the students, particularly in their senior study fourth year, reported being used as 'extra staff' in clinical placements, which is a finding consistent with Hoel and colleagues and contributes to their perception of '*having too much clinical responsibility*' [19]. These problems were identified and a series of solutions were refined and implemented (Table 1), resulting in the mean scores actually declining as students' study year increased (Table 3).

Comparison analysis between each year of students indicated that students in the third year demonstrated highest level stress overall (2.82 ± 0.68) and of education dimension(3.07 ± 0.52). By reviewing the curriculum design and the arrangement of clinical placement it was noted that the only significantly different feature found in the third year was the arranged three weeks overseas clinical placement. We know from Kumar's work that unfamiliar environment, separation from the families and the demand of forming new social groups are contributors to student nurses' stress [20], which may explain why third year students were more stressed than other years' students. Additional support strategies have therefore been implemented.

Whilst, as Gibbons, Dempster and Moutray pointed out, a certain amount of stress is necessary for mental and physical wellbeing, and may motivate and enhance performance, too much can inhibit learning and cause attrition [21]. This study echoes the findings of Prato and colleagues [22], indicating that nursing faculty and preceptors in practice are very well positioned to create

Table 4
Top five stressors perceived by each cohort students.

Student cohort	Stressors	*Mean* ± *SD*
1st year		
	1 The large amount of classwork material to be learned	3.18 ± 0.86
	2 The difficulty of the classwork material to be learned	3.01 ± 0.92
	3 Fear of failing the course	2.83 ± 0.89
	4 Fear of making a mistake in clinical placement	2.80 ± 0.79
	5 Examinations and placement gradings	2.69 ± 0.82
2nd year		
	1 Fear of making a mistake in clinical placements	3.16 ± 0.91
	2 Having too much clinical responsibility	3.02 ± 0.89
	3 Fear of failing in the course	3.01 ± 0.88
	4 Feeling responsible for what happens to patients	2.93 ± 0.90
	5 Caring for the emotional needs of patients	2.61 ± 0.93
3rd year		
	1 Having too much clinical responsibility	3.17 ± 0.76
	2 Fear of making a mistake in clinical placement	3.07 ± 0.93
	3 The amount of classwork material to be learned	3.01 ± 0.76
	4 Fear of failing in the course	2.99 ± 0.91
	5 Feeling responsible for what happens to patients	2.89 ± 0.88
4th year		
	1 Having too much clinical responsibility	3.01 ± 0.92
	2 Fear of making a mistake in clinical placement	2.99 ± 0.82
	3 The lack of free time	2.86 ± 0.87
	4 Feeling responsible for what happens to patients	2.82 ± 0.79
	5 Criticism from peers or senior staff	2.73 ± 0.84

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supportive learning environments to enhance students' clinical learning experience. Having revealed that students were suffering stressful clinical learning environments, this study highlights some strategies to identify effective ways to improve the student experience. The benefits of the iterative methodology were that it allowed for initial solutions to be revisited, refined and improved, which is one of the key aims of scientific study and essential for maintaining continuous improvement to students learning experience. It is worth noting that the internal report from the Student Affairs Office indicates the attrition of nursing students has been remarkably declined recently.

5. Limitations

This study setting was confined only to one local public school of nursing. Therefore, generalization of the results should be made with caution. Dimensions of SINS-CN questionnaire may not address local issues such as multiculturalism and language issues. A modified and validated version of the scale study may be needed.

6. Conclusions

This is one of the first examples of nursing educators and preceptors in Macao adopting an iterative approach to enhance the clinical learning experience of nursing students. Whilst the iterative approach was originated in computer engineering, it was found to be a transferable method to solve very practical issues with effective solutions. After implementation of this method to solve the stressful environments encountered by students, the overall stress score and each sub-dimension score decreased significantly. Therefore, this approach is highly recommended to colleagues in other healthcare environments.

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Conflicts of interest

No financial or authorship conflict among six authors.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijnss.2019.01.005.

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